National Aeronautics and Space Administration

technology opportunity

An Active, Solid-state, 3-Dimensional Range Imaging System

...compact with improved reliability, accuracy, and ruggedness

NASA Goddard Space Flight Center (GSFC) invites companies to license its active, solid-state, 3-dimensional (3-D) range imaging system for use in numerous applications where 3-D information in image form is required for study, digital manipulation, and monitoring. This new technology produces 3-D images and surface characterization using pulsed laser energy, and it can be implemented with no moving mechanical parts (such as mirrors or scanners). This simplified design dramatically increases reliability, accuracy, imaging capability, ruggedness, and service life of the measurement system.

Benefits

- **Compact**: Fiber optic switches and a single laser result in smaller devices
- **Improved image quality**: High number of precisely spaced pixels and no moving parts provide sharper, more accurate images with little jitter and no blurring
- **Versatile**: Device components can be varied to make efficient use of optics, detectors, electronics, and laser transmitters
- **Rugged and long lasting**: No mechanical moving parts lengthens service life and improves reliability
- **Flexible**: Scalable to any number of pixels and pixel resolutions and compatible with a variety of ranging methodologies

Applications

- 3-D vision (e.g., automotive applications, robotic systems, medical imaging)
- Airborne and spaceborne remote sensing (e.g., surface mapping)
- Inspection and docking sensors
- Proximity detectors (e.g., parking sensors, robotic mobility systems)
- Handheld systems (e.g., dental imaging, night vision)

Technology Details

Existing imaging technologies predominantly use mechanical scanning techniques to produce a displacement of a laser beam on a remote target. This improved 3-D range imaging system offers a completely new imaging architecture that can provide order-of-magnitude improvements in terms of number of pixels, image speed, and quality over existing technologies. Its solid-state design results in an extraordinarily reliable, rugged, and long-lasting system.

How it works

By employing fixed fiber arrays with fiber optic switches, the new imaging architecture is a simplified, extremely compact, highly scalable, and efficient optical 3-D imaging system. This system produces high-resolution and high-accuracy 3-D images by projecting pulsed or modulated light energy across a target area and measuring the time of flight and location of each reflected pulse. Additional surface characteristics such as reflectivity, roughness, and density of semi-solid objects (i.e., clouds or vegetation) also can be captured.

Similar in concept to a CCD camera, each fiber of the array represents a pixel of the CCD. The only limits to the number of pixels is the ability to pack a large number of fibers into an array and the speed and efficiency of the optical switching technology, and both of these are rapidly advancing to provide increased capability.

This system provides digital control of the direction and timing of laser light emitters to produce a controlled illumination pattern. The system also has the capability to control the field of view of a receiver system, and the capability to control what portion of the field of view is being directed onto, as well as when it is directed to, a photodetector system. The system can be optimized to operate in a variety of conditions including bright daylight and long-distance ranging applications.

Why it is better

Using optical switches requires a lower number of laser sources (a single laser is possible) and enables a system that is more compact than a discrete beam or mechanically scanned design. Unlike current mechanical scanners, this system has no moving parts which eliminates “blur” and provides sharper, more accurate images. Its system performance optimization feature has not been seen in any previous 3-D imaging system.

Furthermore, by efficiently illuminating each individual pixel and using optical switches to control the amount of background light entering the detector system, this new laser scanner approach enables use of much lower power lasers than would typically be required for a non-scanning, “floodlight” approach, for example.

Patents

NASA Goddard Space Flight Center is seeking patent protection for the technology.

Licensing and Partnering Opportunities

This technology is part of NASA’s Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the Active, Solid-state, 3 Dimensional Range Imaging System (GSC-15184-1) for commercial applications.

For information and forms related to the technology licensing and partnering process, please visit the Goddard’s Licensing and Partnering Web page (http://ipp.gsfc.nasa.gov/lic-partnerships.html).

For More Information

If you are interested in more information or want to pursue transfer of this technology (GSC-15184-1), please contact:

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